SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2021 HIGHLIGHTS

Task 61 - Integrated Solutions for Daylight and Electric Lighting

THE ISSUE

Lighting accounts for approximately 15% of global electric energy consumption and 5% of greenhouse gas. Projections by the IEA show that if governments only rely on current policies, global electricity use for lighting will grow from around 2,900 TWh to around 4,250 TWh by 2030. Due to the world's growing population and the increasing demand for electrically driven services in emerging economies, the increase will occur despite constant improvements in the energy efficiency of lighting systems.

During the last years, there has been a shift towards digitalized lighting because of its ability to overcome problems in the integration of daylight and electric lighting. New technologies equipped with sensors, "intelligent software," and wireless data communication provide opportunities to bring the disconnected market sectors of electric lighting and façade technology closer together.

OUR WORK

Research and developments in the field of energy efficient lighting techniques encompassing daylighting, electric lighting, and lighting controls combined with activities employing and bringing these techniques to the market can contribute significantly to reducing worldwide electricity consumption and CO2 emissions.

Task 61, which ended in 2021, has generated diverse outcomes for different stakeholders:

- **Designers:** New integrated tools, system overview, design guidelines, and system performance information.
- **Standardization bodies:** Integrated daylighting and electric lighting hourly energy rating method and spectral modeling, including new material datasets.
- **Industry:** Better integration of electric lighting and daylighting (façade).
- **Building managers:** More effective guidance on the calibration and ongoing adjustment and maintenance of integrated lighting control systems.
- **Policymakers:** Advice to stimulate deployment of successful, energy efficient lighting schemes with added benefits to citizens.
- **Building users:** Improved indoor conditions to support health, comfort, and energy efficiency.

SHC Task 61 collaborated with the IEA Technology Collaboration Programme on Energy in Buildings and Communities (EBC TCP) in this project.

Participating Countries

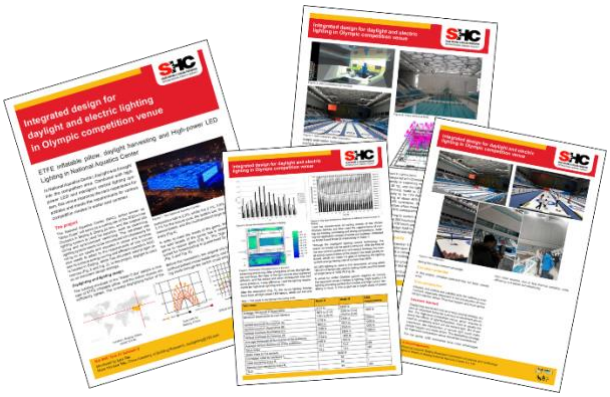
Australia
Austria
Belgium
Brazil
China
Germany
Denmark
Italy
Japan
Netherlands
Norway
Poland
Slovakia
Sweden
Switzerland
USA

Task Period	2018 – 2021
Task Leader	Jan de Boer, Fraunhofer IBP, Germany
Email	jdb@ibp.fhg.de
Website	task61.iea.shc.org

KEY RESULTS IN 2021

Lessons Learned from 25 Case Studies

Experiences from 25 case studies (office, retail, sport/recreation, health, residential) from 12 countries were collected and cross-analyzed, verifying, and in parts, showing drawbacks in applied integrated approaches. To have the appropriate tools at hand, a new monitoring framework had to be developed to properly assess the performance of lighting solutions. This new protocol covers the assessment of energy use (electrical lighting systems), visual effects (Indoor lighting environment/photometry), non-visual effects (circadian potential), and the user (subjective/surveys and observations). Its application helped extract lessons learned from the case studies, which are documented in four-page Fact Sheets each targeting a professional audience:



- The energy demand for lighting can drastically be reduced thanks to the combined effect of more efficient light sources, advances in controls, and raised awareness about the integration of daylighting and electric lighting. Annual lighting energy use as low as 3-4 kWh/m²a is now possible, but still far from being the standard in ordinary projects. Recommissioning, monitoring, and validation are central to achieving the energy results.
- Integrative lighting (often also referred to as 'human-centric lighting' aimed at eliciting human circadian response) is currently driving innovation in lighting technology, and its wider implementation is expected as knowledge expands in the field of non-visual requirements for lighting. Electric lighting will be able to support non-visual requirements when daylight cannot suffice.
- However, in practice, integrative lighting is rarely integrated with daylighting. Up to today, there has been a lack of tools and knowledge for designers to implement daylight in integrative lighting schemes.
- Consequently, integrative lighting may result in significant energy rebounds. Integrative lighting is often designed with disregard to daylight. Electric lighting loads increase to reach appropriate lighting levels for eyes during the daytime when daylight is sufficiently available: more delivered lumens and lower luminous efficacies - if not properly integrated with daylight - jeopardize energy performance.
- Daylighting integration is of utmost importance for achieving quality beyond energy saving. Views outside have been proven to be of primary importance for occupants' satisfaction with a project.
- Integrated design is facing new challenges: from aspects of energy and visibility, questions like comfort and health need to be answered. The design of the integrated projects is more and more explicitly tailored to user needs rather than to the general use of space.

Task 61 Results Online

The results from this 3.5-year project, which drew from the collaborative effort of 55 experts from 37 research institutes, universities, and businesses in 17 countries, can be found on the IEA SHC website https://task61.iea-shc.org/publications.

Proposal for New Task

The good news is our lighting work is not over, the IEA SHC Executive Committee gave its blessing to start developing a new Task. The Task Definition Phase will begin in 2022, building on the work of five earlier SHC Tasks. This proposed Task will work to identify and support lighting (electric and façade: daylighting and passive solar) in the context of decarbonization and energy efficiency. It will be aligned with the new integrative understanding of humans' light needs. So, what does this exactly mean? The project's overarching work areas, which will be discussed during the Task Definition Phase, are the carbon footprint of the lighting value chain, "renegotiating" the role of daylighting as it relates to building facades and the urban context, and digitalization.

Interested in getting in on the ground floor to help define this project? Then now is the time to contact the Task Organizer, Jan de Boer, jdb@ibp.fhg.de. The first workshop is planned for February/ March 2022. The success of the Task will depend on the work of a group of experts with very diverse skill sets – architects, lighting designers, LCA software developers, energy consultants, lighting and lighting control specialists, facility managers, psychologists/experts for non-visual effects, and lighting industry and manufacturing professionals.